BULLETIN 200 APRIL, 1909

IMP. BUR.
16 MAY 1914
ENTOM.

NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

OF THE

COLLEGE OF AGRICULTURE AND MECHANIC ARTS

WEST RALEIGH

FEEDING FERMENTED COTTON-SEED MEAL TO HOGS.

N. C. COLLEGE OF AGRICULTURE AND MECHANIC ARTS.

THE NORTH CAROLINA
AGRICULTURAL EXPERIMENT STATION,

UNDER THE CONTROL OF THE

TRUSTEES OF THE A. AND M. COLLEGE.

GOVERNOR W. W. KITCHIN, *ex officio* Chairman, Raleigh.

R. H. RICKS.....Rocky Mount	J. T. ELLINGTON.....Smithfield
W. D. TURNER.....Statesville	W. E. DANIEL.....Weldon
O. M. GARDNER.....Shelby	W. H. RAGAN.....High Point
LOCKE CRAIG.....Asheville	W. B. COOPER.....Wilmington
C. W. GOLD.....Raleigh	M. B. STICKLEY.....Concord
E. M. KOONCE.....Jacksonville	T. T. BALLENGER.....Tryon
T. W. BLOUNT.....Roper	N. B. BROUGHTON.....Raleigh
D. A. TOMPKINS.....Charlotte	O. L. CLARK.....Clarkton

STATION STAFF.

D. H. HILL, President of the College.

C. B. WILLIAMS.....Director and Agronomist
W. A. WITHERS.....Chemist
F. L. STEVENS.....Vegetable Pathologist
J. S. JEFFREY.....Poultryman
F. C. REIMER.....Horticulturist
R. S. CURTIS.....Animal Husbandman
JOHN MICHELS.....Dairy Husbandman
R. I. SMITH.....Entomologist
G. A. ROBERTS.....Veterinarian
W. A. SYME.....Assistant Chemist
J. G. HALL.....Assistant in Plant Diseases
W. C. ETHERIDGE.....Assistant in Farm Crops
J. K. PLUMMER.....Assistant Chemist
P. L. GAINEY.....Assistant Bacteriologist
A. R. RUSSELL.....Assistant in Field Experiments
A. F. BOWEN.....Bursar
C. P. FRANKLIN.....Secretary and Stenographer

The Bulletins and Reports of this Station will be mailed free to any resident of the State upon request.

Visitors are at all times cordially invited to inspect the work of the Station, the office of which is in the new Agricultural Building of the College.

Address all communications to

N. C. AGRICULTURAL EXPERIMENT STATION,
WEST RALEIGH, N. C.

TABLE OF CONTENTS.

	PAGE.
Summary	4
Introduction	5
Object of experiment	5
Weight of animals, feeds and rations	6
Commercial value of feeds	7
Preparation of feeds	8
Conditions of experiment	8
Comparison of results by tables, with illustrations	9
Discussion of results	11
Gains by periods	14

SUMMARY.

Corn alone proved to be an undesirable ration for growing hogs, causing small gains and unthrift. This condition was more marked, owing to the fact that the lot was closely penned, without pasture; yet the other lots, similarly confined, made relatively larger gains.

Fermented cotton-seed meal can be fed in small quantities for limited periods, with very gratifying results. These experiments indicate that seventy-five to ninety days would be the limit of satisfactory feeding. This would depend, however, on the age and condition of the hogs, the supplementary feeds and the proportion of cotton-seed meal fed.

Lot 3, fed a combination of corn and cotton-seed meal, in the proportion of four to one, made larger and cheaper gains for the first ninety days than the lot similarly fed on corn and linseed meal. This would seem to indicate that, when possible, cotton-seed meal should be used, since it contains a larger quantity of protein and sells for about one-fourth less per ton than linseed meal.

Farmers would, according to the results of this experiment, be safe in feeding fermented cotton-seed meal to seventy-five-pound shoats in quantities ranging from one-sixth to one-fifth the total ration, by weight, for a period of seventy-five to ninety days.

The feeding of the four lots of hogs during the first period was more profitable when one part of cotton-seed meal was added to the ration of four parts corn than when corn alone or corn and linseed meal in combination were fed. In case of linseed meal, however, the greater cost of gain was due to the high price of the feed, and not so much to its lack of efficiency in making gains. Barring this one factor, and the possible danger in feeding cotton-seed meal, the two feeds, according to the results of this experiment, are approximately the same in feeding value when fed for the time stated.

With corn and cotton-seed meal each costing approximately $28 per ton, the results of this experiment show clearly in favor of the combined corn and cotton-seed meal ration, considering always the limitations given as to the amount fed and length of feeding period. While Lots 2, 3 and 4 have had a somewhat larger ration than Lot 1, the larger gains during the first period were sufficient to considerably overbalance this factor.

The practical application of these results would not be to feed under the conditions here described, but rather to feed the corn and cotton-seed meal in connection with grazing crops, which can be produced so abundantly by Southern farmers. This experiment was carried on under adverse conditions to render safe conclusions possible.

When fed with judgment, cotton-seed meal can be made a valuable adjunct to corn as a ration for hogs. It is our cheapest commercial feed supplying protein, and should not be entirely ignored in swine production.

Cotton-seed meal, when fed in quantities, as given in this Bulletin, will, after a time—one hundred to one hundred and twenty days—apparently reduce the normal gains and profits therefrom. This point should be kept in the mind of the feeder, the amount of feed used recorded, and the hogs weighed occasionally. Accurate judgment will direct when to eliminate the meal from the ration. Aim to feed under the limit, however, rather than over.

FEEDING FERMENTED COTTON-SEED MEAL TO HOGS.

By R. S. Curtis, Animal Husbandman.

The Experiment Station has frequently been questioned in regard to feeding cotton-seed meal to live stock. A large number of these inquiries relate to swine and the practicability of feeding cotton-seed meal to these animals. While this is not a new question, and we are aware that cotton-seed meal fed to swine in moderately large quantities is unsafe, frequently causing death, yet it seems highly desirable, when possible, to combine cotton-seed meal with high-priced corn, which is so generally used throughout the State. In making this combination of feeds, which seems especially desirable for growing hogs, because of the high protein content of cotton-seed meal, the feeder should be judicious in his methods and should be guided by the results obtained in this and other experiments reported. In the hands of a careful feeder, fermented cotton-seed meal may be used in small quantities, for a limited time, with good results, but for the indifferent and shiftless feeder it will most likely prove fatal to the growth and health of the animals, and if fed to extreme death will almost invariably result. While no deaths were recorded during this experiment, it is evident, as shown by the results in Table 1, that the last period of feeding was not as satisfactory as the first. The gains were much less and the cost more per pound of gain, and it is possible that the health of the animals might have been materially injured had the experiment continued for a longer time. Nothing definite can be stated in this regard, however, as the hogs were apparently normal when the experiment was completed.

OBJECT OF EXPERIMENT.

1. The experiment was conducted primarily to determine the amount of fermented cotton-seed meal which might be fed with economy and safety, in conjunction with corn, to young and growing hogs.

2. To determine the economy of gain from feeding cotton-seed meal in the proportions specified, and in comparison with corn alone, and with corn and linseed meal combined.

3. To determine the quality of the product produced by the different rations. This portion of the work will be reported in a subsequent Bulletin.

WEIGHT OF ANIMALS, FEEDS AND RATIONS.

The average weight of the hogs at the beginning of the experiment was approximately 70 pounds. The rations fed to the four lots of hogs during the first period were as follows:

Lot 1. Corn.
Lot 2. Corn, 7 parts; cotton-seed meal, 1 part.
Lot 3. Corn, 4 parts; cotton-seed meal, 1 part.
Lot 4. Corn, 4 parts; linseed meal, 1 part.

The feeding was all done in dry lots, measuring 10 x 40 feet, and during a considerable portion of the time the weather was quite unfavorable for large gains. The quality of hogs was not of the best. They were of mixed blood, yet the division into lots was made in such a manner that practically all individuality was overcome. The low grade of the hogs accounts in part for the generally reduced gains obtained, although there were other unfavorable factors. From a comparative standpoint, however, the results are quite conclusive.

Lot 1.—Fed first period, corn alone; and second period, mixture of 4 parts corn and 1 part linseed meal.

On March 29, the end of the first period of three months, the rations were reversed and the lots of hogs were fed as follows:

Lot 1. Corn, 4 parts; linseed meal, 1 part.
Lot 2. Corn, 4 parts; cotton-seed meal, 1 part.
Lot 3. Corn, 7 parts; cotton-seed meal, 1 part.
Lot 4. Corn.

By reversing in this manner, Lots 2 and 3 still remained on the cotton-seed meal ration, since it was not desirable to cut off this part of the experiment, as one of the objects was to determine the amount

of fermented meal which could be fed and the length of time this could be continued without the development of unfavorable results.

It is also important to know just when cotton-seed meal begins to show a detrimental influence on the health and thrift of the pig.

By reversing Lots 2 and 3 in the manner indicated, Lot 3 received all during the feeding trials a ration which conforms fairly accurately with our present idea of rational feeding. During the first part of the period the cotton-seed meal was fed in larger quantities to stimulate the growth of bone and muscle, while in the last period of fattening it was reduced just enough to balance the corn ration and at the same time keep within the bounds of safe feeding.

On the other hand, Lot 2 was fed only seven parts of corn with one part of cotton-seed meal during the first period, the results being less satisfactory than those obtained from Lot 3 during this period, as shown by Table 1. After reversing the ration and placing Lot 2 on a larger amount of cotton-seed meal, thus subjecting them to the meal gradually, the results were somewhat more satisfactory than those obtained during the second period of Lot 3, from the standpoint of the amount of feed eaten, pounds of feed used per pound gain, and cost of the gains. There was not enough difference, however, to warrant definite conclusions, as indicated by Table 1. The total gain made during the feeding period of six months was in favor of Lot 3, fed the larger quantity of cotton-seed meal during the first period. The results indicate that the linseed meal stimulated a relatively larger gain during the second period with Lot 1 than was made during the first period with Lot 1 when fed on corn. The corn alone caused larger gains during the second period with Lot 4 than was made with either Lots 2 or 3 during the corresponding period, when the hogs were fed cotton-seed meal as a supplement. This would seem to indicate that an all-corn ration is more effective in making gains during this period of feeding, and that either the nitrogenous supplement is not needed or the cotton-seed meal is detrimental after a certain stage of feeding.

During the feeding period of six months no signs of sickness were evident, and the increased gain made by Lot 3 during the first period shows plainly the desirability of adding limited quantities of the fermented cotton-seed meal to the ration for the length of time given in the results.

The hogs were weighed each week during the experiment, and a fairly substantial gain was made, especially during the first period, in favor of Lots 3 and 4.

COMMERCIAL VALUE OF FEEDS.

In placing a value on a feed stuff it is customary to take into consideration the actual cash value of that feed on the market. It is a fact, however, that if the farm products are fed and the manure placed

on the land any man could afford to take actually less than market value when the same is marketed in the form of pork, and retain the manure on the land rather than sacrifice this valuable material. It should be the aim always to market home-grown products in the form of beef, pork or mutton, and thereby secure the increase over the market price of the feed, when the conditions are such as to make it possible.

In rating the feeds used in this experiment, the common practice has been followed of figuring them at the exact market value at the time the experiment was conducted. This was necessary, as no provision was made for determining the value of the manure at the time the experiment was planned.

The prices assigned to the different feeds were, for corn, $28; cotton-seed meal, $28, and for linseed meal, $35 per ton.

This places the cost of gains at a maximum figure; but if we were to actually determine the enhanced value to the land, where the hogs are properly bedded and the manure conserved and applied to the land, the cost of production would be materially reduced.

PREPARATION OF FEEDS.

During the winter months it was necessary to prepare the rations from two to three days in advance of feeding, in order to have them thoroughly sour. After the weather became warm, however, twenty-four to thirty hours were generally sufficient to bring about the desired condition. In preparing the feeds the shelled corn and combinations of cotton-seed meal and linseed meal with corn were weighed out into tin buckets, in the proper proportions, well mixed, covered with water and stirred thoroughly. The buckets were then placed on a shelf and allowed to stand until the rations were fed. The feeds for the four lots were all given the same fermentative treatment, as it was necessary to do this in order to correct any favorable or unfavorable results which might arise from soaking and fermenting the cotton-seed meal rations for Lots 2 and 3.

In every case, with the exception of Lot 1, the feeds were eaten with apparent relish. With this lot, however, a dull, stupid condition and depressed appetite developed with all the pigs after a lapse of three or four weeks.

CONDITIONS OF EXPERIMENT.

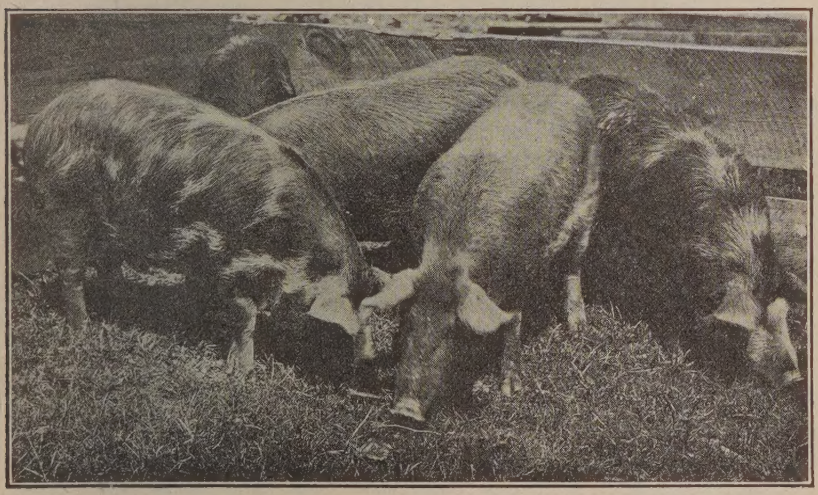
The experiment proper was conducted for six months, beginning January 29 and ending July 29, 1908, and was divided into two periods of three months each. At the beginning of the second period the rations were reversed.

For the first three months of the final feeding period six pigs were used in each of the four lots, but during the last three months only

five were used, because two "piggy" sows had to be removed from two of the lots. To balance this, one pig was taken from each of the other lots.

In making the division great care was taken to divide the hogs into lots of as nearly the same weight and type as possible, in order to eliminate individuality.

The pigs were all closely penned during the experiment—a condition most unfavorable for large gains with young hogs. The gains, without doubt, would have been greater had the hogs been allowed a run on green pasture; but as it was the desire to place them under the most unfavorable conditions, owing to the peculiar nature of the experiment, they were penned in dry lots. During the first feeding period especially, the muddy condition of the lots was partly responsible for the decreased gains made with the hogs as a whole.



Lot 2.—Fed first period, mixture of 7 parts corn and 1 part cotton-seed meal; and second period, mixture of 4 parts corn and 1 part cotton-seed meal.

COMPARISON OF RESULTS BY PERIODS.

The following table shows in a concise way the points of special interest brought out by feeding the four lots of hogs. The illustrations show quite clearly the marked differences in the quality of the lots. This is very strikingly shown in the case of Lot 1, which was fed on corn alone. The condition of the lot, as indicated in the cut on page 6, shows all evidences of unthrift. In case of Lots 2, 3 and 4 the difference is not so marked, although Lots 3 and 4 are smoother and more uniform throughout. The photographs were taken shortly before the conclusion of the experiment.

A close observation of the cuts by the reader may make it seem that the hogs in Lot 1, fed on corn alone, were decidedly inferior in quality. This was not the case, however, as particular efforts were given to the matter of selecting the hogs in each lot as uniformly as possible. The division was made according to weight, type and quality, which were distributed equally. An examination of the records will show that the weights of all lots were practically identical at the beginning of the experiment. The condition of the animals was also quite uniform. Outside of the different supplementary feeds used, the treatment of the four lots was the same. All were confined in feeding pens, where they were fed three times each day—morning, noon and night; and throughout the experiment a mixture of ashes, charcoal, lime, sulphur, copperas and turpentine was fed three times per week. The unthrifty condition of Lot 1 developed gradually, becoming especially noticeable after the first three or four weeks of feeding. As the pigs in this lot refused to eat their ration, it was reduced at times to an amount so small that one good, thrifty hog would have readily eaten it.

TABLE 1—SHOWING KIND AND PROPORTION OF FEEDS, WEIGHT OF HOGS AT BEGINNING AND END, AMOUNT OF FEED EATEN, AND COST OF GAIN.

	First Period—90 Days.				Second Period—91 Days.			
	Lot 1—Fermented Shelled Corn.	Lot 2—Fermented Shelled Corn and Cotton-seed Meal.	Lot 3—Fermented Shelled Corn and Cotton-seed Meal.	Lot 4—Fermented Shelled Corn and Linseed Meal.	Lot 1—Fermented Shelled Corn and Linseed Meal.	Lot 2—Fermented Shelled Corn and Cotton-seed Meal.	Lot 3—Fermented Shelled Corn and Cotton-seed Meal.	Lot 4—Fermented Shelled Corn.
Proportion in which feeds were fed	Corn Alone.	7:1	4:1	4:1	4:1	4:1	7:1	Corn Alone.
Average weight in pounds at beginning	73.30	75.30	75.30	75.10	97.40	122.00	141.40	135.00
Average weight in pounds at end	89.50	116.60	132.00	129.10	117.00	144.00	164.00	168.00
Average gain per head by periods	16.20	41.30	56.70	54.00	19.60	22.00	22.60	33.00
Average daily gain in pounds per head	.18	.46	.63	.60	.21	.24	.25	.36
Total pounds of feed eaten per pig	208.04	275.50	289.37	289.37	164.65	235.97	270.80	261.20
Average number pounds of feed consumed daily per pig	2.31	3.06	3.22	3.22	1.81	2.59	2.98	2.87
Pounds feed eaten per pound gain	12.84	6.67	5.10	5.36	8.40	10.72	11.93	7.91
Average number pounds of supplementary feed eaten daily per pig	.00	.38	.62	.62	.33	.46	.37	.00
Total number pounds of supplementary feed eaten per pig	.00	34.44	55.25	55.25	29.80	41.65	33.85	.00
Cost in cents per pound gain	18.00	9.33	7.14	7.86	12.30	15.00	16.70	11.07

DISCUSSION OF RESULTS.

The corn ration fed to Lot 1 proved to be very unsatisfactory. This ration is fed, however, to young hogs, in the majority of instances, in this State; and from the large number of bulletins which have already called attention to the excessive cost of production from feeding young hogs on corn alone, it seems as though the information should be widespread, and that farmers would be eager to discontinue the practice. Many farmers, however, are yet feeding high-priced corn to breeding and growing hogs, in the face of these facts.

The gain made by the six hogs in Lot 1 was 97 pounds during the first period. This is very little more than one good, thrifty shoat should have made in the same time, granting that the ration was made from proper feeds, containing sufficient protein and ash for muscle and bone production.

It required 12.84 pounds of feed to produce one pound of gain, representing a cost of 18 cents per pound. The average gain per day was only .18 pounds, whereas it should have been at least one-half or two-thirds of a pound, with a properly balanced ration.

During the last period, after changing the ration to a mixture of corn and linseed meal, the average gain per day was greater than during the first period. It required 8.4 pounds of feed to produce a pound of gain, one-third less than during the former period, which represents a cost of 12.30 cents per pound of pork. Had the pigs not been stunted by feeding on corn alone during the first period, the difference would in all probability have been much greater.

The fact should be considered that five pigs made a total gain of 98 pounds during the second period, whereas six pigs made a gain of 97 pounds during the first period. This gain is favorable to the corn and linseed-meal ration, which was fed under very unfavorable conditions.

Table 1 shows a marked improvement in the gains made by Lot 2 during the first period, when a small amount of fermented cotton-seed meal was fed. While the amount fed per day was less than one-half pound, the gain during the first period was .46 pound per day, with a consumption of 6.67 pounds of feed, representing a cost of 9.33 cents per pound of pork. While this is not in the bounds of profitable production, yet it shows a marked improvement over Lot 1, which was fed on corn alone during the first period.

During the last period Lot 2 made much less satisfactory gains than during the first period. The gain per day was very little more than one-half that made during the first period. This was made at a greater cost of feed consumed, 10.72 pounds per pound gain, which represented an actual cost of 15 cents per pound. While we would naturally expect the gains to be less during the last period, yet this

small gain seems to indicate that there is a limit in feeding the meal, even though no toxic symptoms had developed in the animal before the close of the feeding period.

Lot 3 made very satisfactory gains during the first period, considering the conditions under which the hogs were kept. An average of .62 pound of cotton-seed meal was fed per day during this period, with an average daily gain per head of .63 of a pound. This gain represents the highest average made by any lot during the feeding trials. It required only 5.10 pounds of feed to produce a pound of gain, the gains being made at a cost of 7.14 cents per pound, which was the most economical gain made by any lot during the experiment.

Lot 3.—Fed first period, mixture of 4 parts corn and 1 part cotton-seed meal; and second period, mixture of 7 parts corn and 1 part cotton-seed meal.

The results seem to be clearly in favor of Lot 3 during the first period. Even when compared with the first period of Lot 4, it will be found that the gains made per day were greater and the cost per pound was less.

During the second period there was a marked decrease in the gains made per day by Lot 3. The .25-pound gain made during the second period represents only two-fifths of that made during the first, while the cost per pound was more than doubled.

This serves as a check on the results obtained in Lot 2, apparently corroborating the statement made that if the limitations in cotton-seed meal feeding are exceeded, the gains will be small and unsatisfactory, and even death may result.

With Lot 4 the results during the first period were very similar to those obtained with Lot 3 during the corresponding period. The average daily gains were practically the same, the amount of feed consumed was the same, and the amount of feed used per pound of gain was slightly in favor of the corn and cotton-seed meal ration. As to the cost of gain, there was a difference of 72 cents per 100 pounds in favor of the cotton-seed meal ration.

During the second period the results were reversed. The gains made, the amount of feed consumed per pound of gain, and the cost of gains were clearly in favor of the lot fed corn alone. These results point to the conclusion that ninety days or even less is the extreme limit in cotton-seed meal feeding, under the conditions here described. While we grant that corn would naturally be favorable to large gains during the last stage of fattening, we ordinarily accept the statement that a small amount of nitrogenous material would be helpful when fed in connection with corn. This was not true during the last period with Lot 3. The results were decidedly unfavorable to the meal, when compared with the second period of Lot 4.

For all practical purposes, a ration made up of four parts corn and one part linseed meal is, so far as the results obtained in this experiment are concerned, equal to a ration of corn four parts, cotton-seed meal one part. This is on a basis of efficiency, however, as the linseed meal costs more. Consequently the results would be less satisfactory, financially, when linseed meal was fed. This comparison does not hold good, however, after the first period of feeding, as we find by the results given in Table 1, that the gains made by Lot 4 during the second period were considerably more than the gains made by Lot 3 during the second period, when eating cotton-seed meal. The cost of gain on Lot 4 during the same period was also less than that of Lot 3 during the corresponding period. This again seems to point toward the fact that the limitations of meal feeding have been more or less accurately determined, not only in this experiment, but also by others reporting on the subject.

GAINS BY PERIODS.

The weights of the four lots of hogs at the beginning and ending of the two feeding periods were as follows:

TABLE 2—RATIONS AND GAINS OF THE HOGS BY LOTS AND BY PERIODS.

Lot Number.	First Period—90 Days.				Second Period—91 Days.				Total Gain of Lots for Two Periods—Pounds.
	Ration.	Initial Weight, January 29—Pounds.	Final Weight, April 29—Pounds.	Net Gain for Period—Pounds.	Ration.	Initial Weight, April 29—Pounds.	Final Weight, July 29—Pounds.	Net Gain for Period—Pounds.	
1	Corn	440	537	97	Corn, 4 parts; linseed meal, 1 part.	487	585	98	195
2	Corn, 7 parts; cotton-seed meal, 1 part.	452	700	248	Corn, 4 parts; cotton-seed meal, 1 part.	610	720	110	358
3	Corn, 4 parts; cotton-seed meal, 1 part.	452	792	340	Corn, 7 parts; cotton-seed meal, 1 part.	707	820	113	453
4	Corn, 4 parts; linseed meal, 1 part.	451	775	324	Corn	675	840	165	489

The gain of Lot 1, fed on corn and linseed meal during the second period, was practically the same as the gain made during the first period, when fed on corn alone. Large gains were not expected, however, during the second period, since the general condition of the animals had been greatly impaired by feeding them on the corn ration. The gain per pig was greater, however, since during the first period six pigs were used in each lot, and during the second period only five pigs were used.

This indicates that the addition of linseed meal to the ration during the second period had stimulated greater gains; and the fact that the gains made by Lots 2, 3 and 4 during the second period were materially decreased, as compared with the first period, would add some force to the statement that the limit of profitable cotton-seed meal feeding had been reached after seventy-five to ninety days. This fact could not be taken as conclusive evidence, however, as the addition of linseed meal to the ration of Lot 1 would naturally have an appetizing influence, which would stimulate in making relatively larger gains, and especially would this be so, considering the run-down condition of the pigs in this lot.

On the other hand, we have a factor always to be considered, and that is that the gains made during the last stages of fattening are always less than during the first part of the period, and that generally the cost is more per pound of gain. This, then, accounts partly for the results obtained with Lots 2, 3 and 4. How much to attribute to the detrimental influences of the cotton-seed meal during this particular stage of feeding is a question to be worked out later by extensive experiments.

It seems, however, in the case of Lot 3, that the gain during the second period is so small, absolutely and relatively, when compared with the gain made by Lot 3 during the first period, that the cotton-seed meal, after a certain time, becomes a disturbing factor. In the light of these results, and other evidence at hand, the period during which cotton-seed meal can be fed profitably will depend on the amount of cotton-seed meal fed, the size of the hogs and the general feeding and management. In this particular case seventy-five to ninety days was the maximum limit, and even in the case here mentioned the gains were not profitable. The writer is of the opinion that, under a proper system of management, especially if pasture or some suitable grazing crop is supplied, the gains would have been made profitably, at least, certainly more so than when corn alone or a mixture of corn and linseed meal was fed.

Lot 4.—Fed first period, mixture 4 parts corn and 1 part linseed meal; and second period, corn alone.

Lot 2, during the second period, made a gain of 110 pounds, against 248 pounds during the first three months. Their ration was the same in both periods, except that the proportion of cotton-seed meal given during the second period was greater than during the first. The difference in the gain made by this lot during the first and second periods could be more easily accounted for than in the case of Lot 3, since in the latter the cotton-seed meal was reduced, making a more highly carbonaceous ration, from which we would naturally expect comparatively rapid gains, considering the commonly accepted views on

feeding. There is not enough evidence, however, in the case of Lot 2, to conclude that the cotton-seed meal had any influence in checking the gains, since naturally they would be decreased somewhat.

On the other hand, Lot 3, fed corn and cotton-seed meal in the proportion of four to one during the first period, and seven to one during the second period, made a gain of only 113 pounds during the latter, as against 340 pounds during the former period, which was more than three times as much gain in the first as in the second period. It is possible that this extreme difference might be attributed to the age and condition of the animals during the latter period, yet it does not seem that the decrease would be so great on hogs capable of taking on more flesh and fat, as was the case with this lot.

Lot 4 made a more substantial gain, it being 165 pounds during the second period, as against 324 pounds during the first period. This, however, we would naturally expect, to a certain extent, as corn is a fattening ration, and was given at a time when hogs would make the best use of it. After making a good growth of bone and muscle on feeds such as a combination of corn and linseed meal furnished during the first period, larger gains were made than would have been otherwise.

In case of Lot 4 some strength is given to the claim that cotton-seed meal does influence unfavorably the normal gains after a period of about three months. It is a commonly accepted fact that a small amount of protein feed, such as linseed meal, tankage, etc., added to a corn ration, will make the gains larger and at times more profitable. It would therefore seem that the cotton-seed meal fed to Lot 3 during the second period was given in about the right proportion to induce larger gains. Such was not the case, however, as the meal was a detrimental factor, as Lot 3 made only 113 pounds of gain during the second period, while Lot 4 made 165 pounds, or about one-third more gain than Lot 3. Whether this difference in gain can be attributed to the peculiar physiological effect of the cotton-seed meal is to be determined later. These results seem to point toward such a conclusion.